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A star-crossed new species of *Draconarius* Ovtchinnikov, 1999 (Araneae, Agelenidae) from Southwest China, which male and female previously misattributed to two different species

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Abstract: A new species of the genus *Draconarius* Ovtchinnikov, 1999 is described from Sichuan Province, Southwest China: *Draconarius feng* **sp. nov.** (♂♀). The male of the new species was misidentified as *D. syzygiatus* (Zhu & Wang, 1994) and erroneously matched with the female holotype, while the female of the new species was mismatched with the male holotype of *Draconarius annulatus* L. Y. Wang, Y. C. Wang, Wu & Zhang, 2021. Coloration photographs, detailed descriptions and distributional map of the new species and *D. syzygiatus* are provided.

Keywords: Biodiversity, Coelotinae, morphology, new species, redescription, taxonomy

命途多舛：雌雄个体曾分别被误归他种——中国西南地区龙隙蛛属一新种（蜘蛛目：漏斗蛛科）

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摘要：本文报道了产自中国西南地区四川省的龙隙蛛属 *Draconarius* Ovtchinnikov, 1999 一新种：凤龙隙蛛 *Draconarius feng* **sp. nov.** (♂♀)。该新种的雄性曾被错误地与双轮龙隙蛛 *D. syzygiatus* (Zhu & Wang, 1994)的雌性正模配对，而其雌性则被错误地与环龙隙蛛 *Draconarius annulatus* L. Y. Wang, Y. C. Wang, Wu & Zhang, 2021 雄性正模配对。本文提供了该新种与双轮龙隙蛛的彩色照片、详细描述与分布图。

关键词：生物多样性，隙蛛亚科，形态学，新物种，重描述，分类学

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Introduction

Draconarius syzygiatus (Zhu & Wang, 1994) was originally described by Zhu & Wang (1994), based on a female holotype and a male paratype, collected from Mount Emei, Sichuan Province. Wang *et al.* (2021) later proposed that *D. syzygiatus* was mismatched based on specimens collected under one single rock, and described the true conspecific male. Thus, the original male of *D. syzygiatus* became an undescribed species.

During our examination of specimens collected from Longcanggou National Forest Park, 170 km away from Mount Emei, we discovered both sexes of the true *D. syzygiatus*, confirming Wang's conclusion, as well the original male of *D. syzygiatus*. Notably, the female of *D. annulatus* L. Y. Wang, Y. C. Wang, Wu & Zhang, 2021 was found together with the original male of *D. syzygiatus*, under one single rock or adjacent rocks. Furthermore, this combination can be generally discovered among specimens collected from Mount Emei and Mount Qingcheng (approximately 200 km away from both Mount Emei and Longchanggou). Therefore, we propose that the female of *D. annulatus* was mismatched and actually represents a new species conspecific with the original male of *D. syzygiatus*. In this paper, we describe the new species and redescribed *D. syzygiatus.* Examined specimens are deposited in the Natural History Museum of Sichuan University in Chengdu, China (NHMSU).

Material and methods

All specimens were preserved in 75% ethanol and examined with an Olympus SZX7 stereomicroscope. Male palps and female genitalia were examined and photographed after dissecting the spider bodies, epigynes were cleared with Proteinase K. Photographs were taken with a Canon EOS 90D wide zoom digital camera (8.5 megapixels) mounted on an Olympus BX 43 compound microscope. The images used in this paper were montaged using Helicon Focus 7.0.2 image stacking software. Left palps are illustrated. Leg measurements are given as: total length (femur, patella, tibia, metatarsus, tarsus). Only the structures on the left (e.g., pedipalpus, legs) would be measured. Abbreviations used in the text are as follows:

Morphological characteristics: **ALE** = anterior lateral eye; **AME** = anterior median eye; **AME–ALE** = distance between AME and ALE; **AME–AME** = distance between AME and AME; **ALE–PLE** = distance between ALE and PLE; **AME–PME** = distance between AME and PME; **PLE** = posterior lateral eye; **PME** = posterior median eye; **PME–PLE** = distance between PME and PLE; **PME–PME** = distance between PME and PME.

Depositories of the specimens: **JLU** = Jilin University; **NHMSU** = the Natural History Museum of Sichuan University in Chengdu, China.

Taxonomy

Family Agelenidae C. L. Koch,1837 漏斗蛛科

Subfamily Coelotinae F. O. Pickard-Cambridge, 1893 隙蛛亚科

Genus *Draconarius* Ovtchinnikov, 1999 龙隙蛛属

Type species. *Draconarius venustus* Ovtchinnikov, 1999.

Draconarius feng sp. nov. 凤龙隙蛛

https://zoobank.org/018D55DC-C9EB-40F9-9EA0-B2958085BD10

Figs 1–3, 6A, B, 7

Coelotes syzygiatus Zhu & Wang, 1994: 37, f. 1–4 (♂).

Coelotes syzygiatus: Song, Zhu & Chen 1999: 378, f. 225G–H, 227C, 228F (♂).

Draconarius syzygiatus: Wang 2003: 551.

Draconarius syzygiatus: Zhu, Wang & Zhang 2017: 382, f. 247A–D (♂).

Draconarius annulatus L. Y. Wang, Y. C. Wang, Wu & Zhang, 2021: 291, 308, f. 7a–g, 65a–g (♀).

Type material. Holotype: ♂, **CHINA, Sichuan Province:** Ya'an City, Yinjing County, Longcanggou National Forest Park, 29.6247°N, 102.8863°E, elevation: 1447 m, 19.VII.2020, Yi-Yan Li & Mian Wei leg.; **Paratypes:** 3♂♂2♀♀, same data as holotype; 5♂♂7♀♀, **CHINA, Sichuan Province:** Leshan City, Huangwan County, Mount Emei, near Shengshui Temple, 29.5637°N, 103.1042°E, elevation:824 m, 1.X.2018, Mian Wei leg.; 6♂♂5♀♀, **CHINA, Sichuan Province:** Chengdu City, Dujiangyan County, Tai'an ancient town, back range of Mount Qingcheng, 30.9307°N, 103.4871°E, elevation:1291 m, 2.V.2018, Mian Wei leg.; 2♂♂1♀, **CHINA, Sichuan Province:** Chengdu City, Dujiangyan County, Tai'an ancient town, back range of Mount Qingcheng, 30.9307°N, 103.4871°E, elevation:1291 m, 7.VIII.2018, Mian Wei leg.; 3♂♂3♀♀, **CHINA, Sichuan Province:** Chengdu City, Dujiangyan County, Tai'an ancient town, back range of Mount Qingcheng, 30.9307°N, 103.4871°E, elevation:1291 m, 1.XI.2018, Mian Wei leg.; 3♂♂3♀♀, **CHINA, Sichuan Province:** Chengdu City, Dujiangyan County, Tai'an ancient town, front range of Mount Qingcheng, 30.8973°N, 103.5729°E, elevation: 784 m, 2.IV.2019, Mian Wei leg.

Etymology. The species name of the new species "feng" is in reference to the divine bird in ancient Chinese myth, which incorporated attributes of the Phoenix and became a symbol of rebirth in modern times, indicates the "rebirth" of the new species; noun in apposition.

Diagnosis. The male of the new species can be distinguished from other *Draconarius* species by the short and horizontal ridge liked patellar apophysis (Fig. 1F), and the extremely long and band-shaped conductor which is longer than the cymbium (Fig. 1A–E) (vs. patellar apophysis usually digitated and with conductor shorter than cymbium in other congeners). The female of the new species resembles *Draconarius trifasciatus* (Wang & Zhu, 1991) by having a wide atrium, a pair of flat epigynal teeth, and coiled copulatory ducts (Fig. 2; Fig. 260 in Zhu *et al.*, 2017). But can be distinguished from the latter by 1) the width of atrium subequal to 1/2 the width of epigynal plate (Fig. 2A) [vs. much more than 1/2 the width of epigynal plate in the latter (fig. 260A in Zhu *et al.*, 2017)]; 2) left copulatory duct coiled clockwise, and with flat and everted second coil of copulatory ducts (Figs 2B, 3) [vs. the left copulatory duct coiled anticlockwise, and with tube-shaped copulatory ducts in the latter (fig. 260B in Zhu *et al.*, 2017)].

Description. Male holotype (Fig. 6A). Carapace reddish brown (gray in living male). Cervical and radial groove distinct. Cephalic region relatively flat, lateral margin with distinct furrows. Chelicerae with three promarginal teeth and two postmarginal teeth, condyle yellow. Sternum longer than wide. Abdomen pale yellow with 6 chevron-shaped patterns, covered by hairs. Total length 10.60. Carapace 5.01 long, 3.68 wide, cephalic region 2.30 wide. Abdomen 5.12 long, 3.15 wide. Eye size and interdistance: AME 0.18, ALE 0.28, PME 0.20, PLE 0.25; AME–AME 0.10, AME–ALE 0.07, AME–PME 0.08, ALE–PLE 0.06, PME–PME 0.11, PME–PLE 0.21. Leg measurements: I 17.12 (4.45 + 1.52 + 4.40 + 4.27 + 2.68), II 14.56 (4.06 + 1.38 + 3.47 + 3.58 + 2.38), III 13.85 (3.75 + 1.41 + 2.84 + 3.82 + 2.12), IV 17.65 (4.51 + 1.58 + 4.09 + 5.23 + 2.33).

Palp (Fig. 1). Patellar apophysis wide and horizontal ridge shaped. Retrolateral tibial apophysis broad and large, fused with lateral tibial apophysis, which with round tip and extended dorsally. Prolateral tibial apophysis present, short and blunt. Cymbium slim, length of cymbial furrow more than 1/2 the length of cymbium. Subtegulum large, tegulum relatively small and round, nearly covered by the large tegular sclerite from ventral view. Conductor extremely long and band-shaped, longer than cymbium, tip acuminate but with leaf-shaped expension. Ventral margin of conductor brown and sclerotized, twisted to dorsal side after the first turning, with small basal lamellar carrying dense spinules; dorsal margin of conductor ivory and membranous, twisted ventral side after the first turning, with a small and distally sclerotized basal lamellar. Dorsal apophysis of conductor long and triangular-boyonet-shaped. Embolus slim and long, with small embolic base. Median apophysis large, human-ear-shaped, with sclerotized and curved anterior and posterior margin, median part membranous.

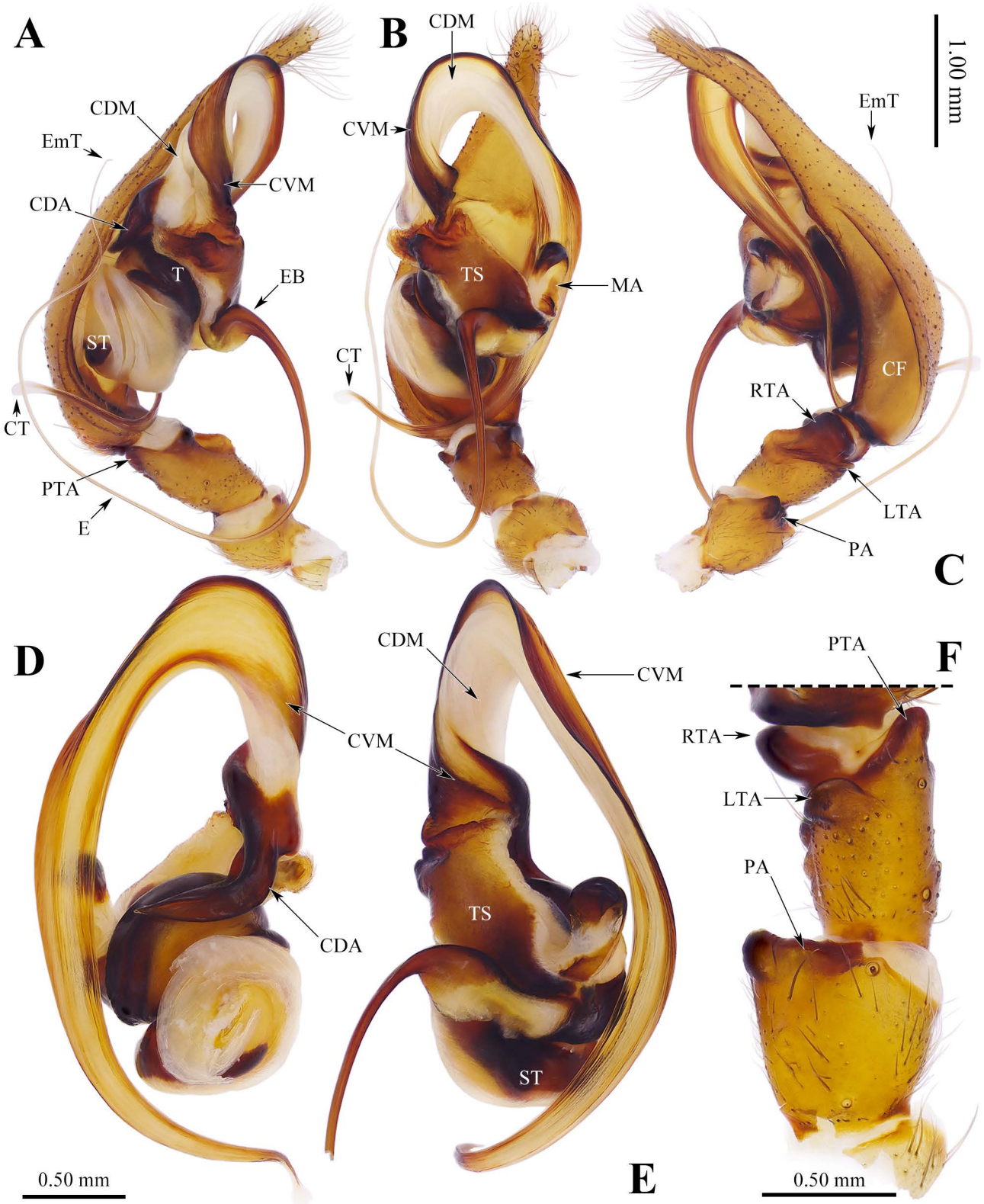

FIGURE 1. *Draconarius feng* **sp. nov.**, male holotype: **A** left palp, prolateral view **B** ditto, ventral view **C** ditto, retrolateral view **D** right bulb horizontally flipped, dorsal view **E** ditto, retrolateral view **F** left tibia and patella, dorsal view. Abbreviations: CDA = dorsal apophysis of conductor; CDM = dorsal margin of conductor; CF = cymbial furrow; CT = tip of conductor; CVM = ventral margin of conductor; EB = embolic base; Em = embolus; EmT = embolic tip; LTA = lateral tibial apophysis; MA = median apophysis; RTA = retrolateral tibial apophysis; PA = patellar apophysis; PTA = prolateral tibial apophysis; ST = subtegulum; T = tegulum; TS = tegular sclerite.

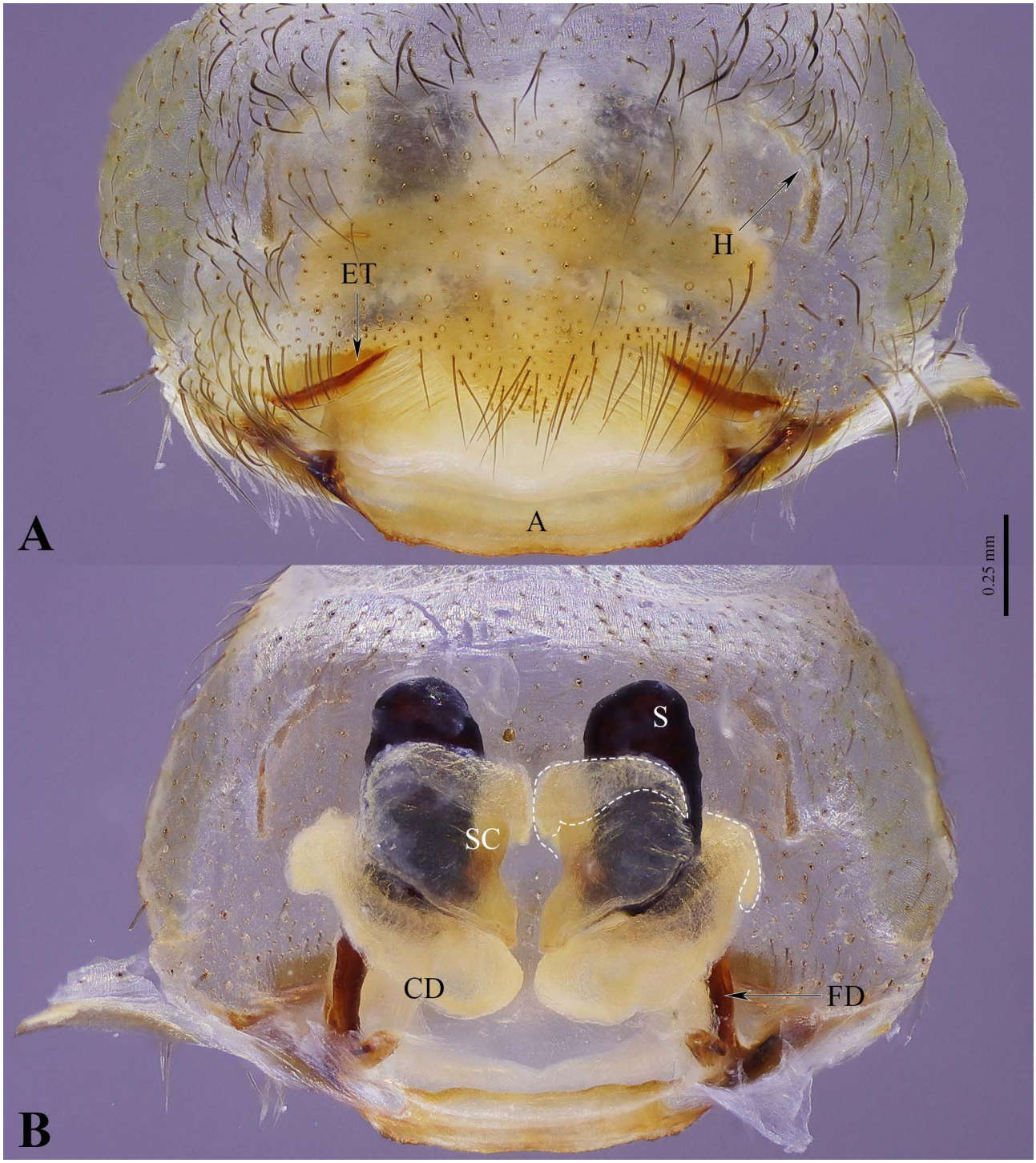

FIGURE 2. *Draconarius feng* **sp. nov.**, female: **A** epigyne, ventral view **B** vulva, dorsal view. Abbreviations: A = atrium; CD = copulatory duct; ET = epigynal tooth; FD = fertilization duct; H = hood; S = spermatheca; SC = second coil of copulatory duct.

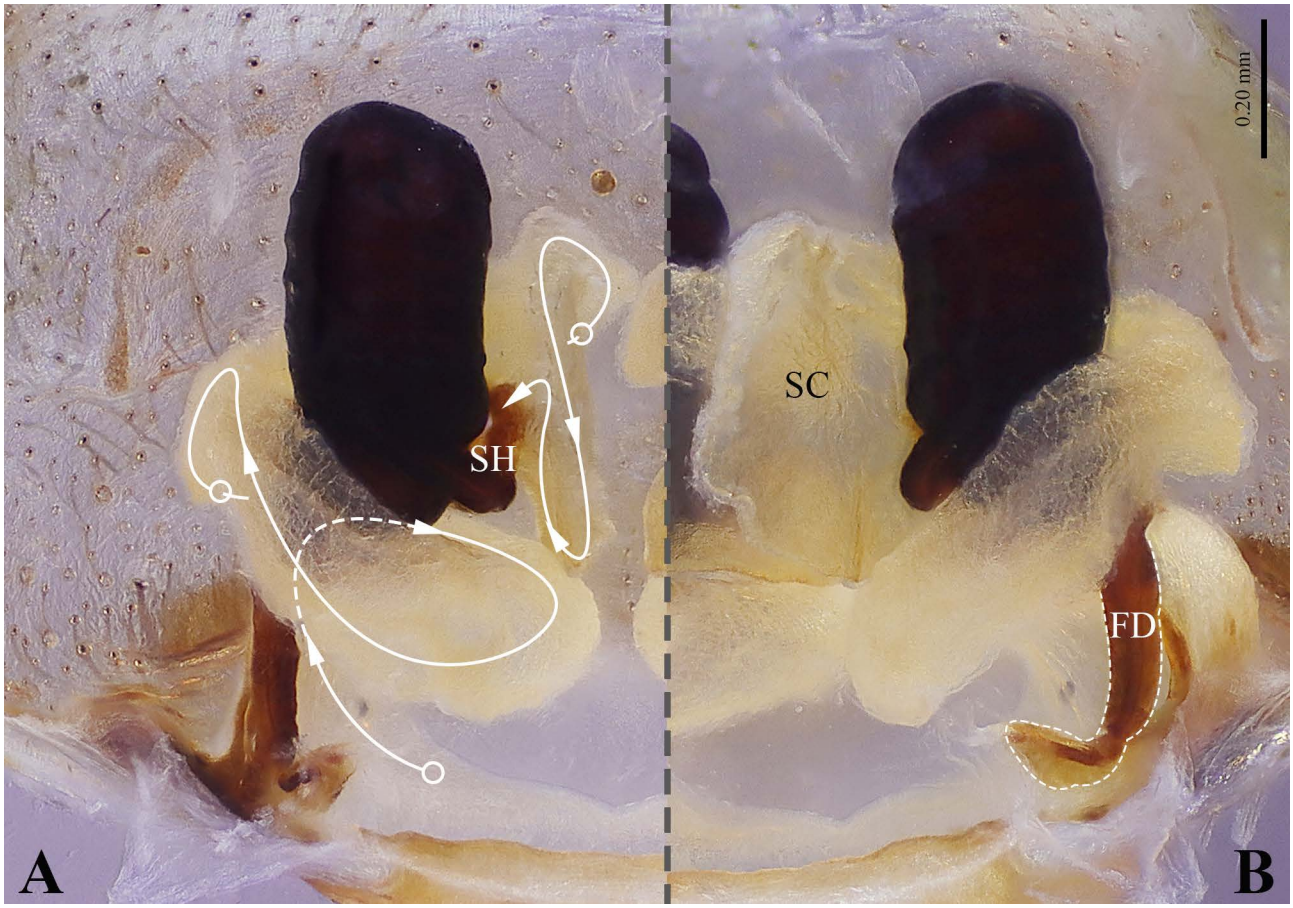

FIGURE 3. *Draconarius feng* **sp. nov.**: **A** vulva left side (with copulatory duct uncovered, white lines indicate the track of copulatory duct), dorsal view **B** ditto, right side, dorsal view. Abbreviations: FD = fertilization duct; SC = second coil of copulatory duct; SH = spermathecal head.

Female paratype (Fig. 6B). Same in color and abdominal patterns as male. Chelicerae with three promarginal teeth and two postmarginal teeth, condyle yellow. Sternum longer than wide. Abdomen pale yellow with 6 chevron-shaped patterns, covered by hairs. Total length 9.69. Carapace 4.85 long, 3.54 wide, cephalic region 2.53 wide. Abdomen 4.76 long, 3.13 wide. Eye size and interdistance: AME 0.15, ALE 0.28, PME 0.20, PLE 0.24; AME–AME 0.08, AME–ALE 0.07, AME–PME 0.08, ALE–PLE 0.07, PME–PME 0.14, PME–PLE 0.22. Leg measurements: I 14.24 (3.87 + 1.55 + 3.75 + 3.23 + 2.2), II 12.38 (3.60 + 1.47 + 2.90 + 2.80 + 2.02), III 11.81 (3.37 + 1.40 + 2.62 + 2.94 + 1.82), IV 15.69 (4.09 + 1.29 + 3.72 + 4.29 + 2.30).

Epigyne (Figs 2, 3). Epigynal plate large, weakly sclerotized, with furrows beneath epigynal teeth. Atrium posteriorly situated, width of atrium 6 times longer than length. Epigynal teeth situated above atrium, wide and flat. Hoods laterally situated. Copulatory ducts coiled, long and thick, second coil flat and everted. Spermathecae large, bar-shaped, with thin spermathecal head connected with copulatory ducts, situated inner side. Fertilization ducts long and thick, the length subequal to spermathecae.

Notes. Based on several morphological characteristics, including a small, dorsally situated lateral tibial apophysis, a long cymbial furrow, a long, band-shaped conductor, and a slim, extending embolus in the male palp, we identified our male specimens conspecific with the original male of *D. syzygiatus* (Figs 3, 4 in Zhu & Wang, 1994). And we identified our female specimens conspecific with the female of *D. annulatus* (Fig. 7f, g in Wang et al., 2021) based on their posteriorly situated and wide atrium, short and flat epigynal teeth, membranous and twice-coiled copulatory duct, and long fertilization duct.

Distribution: China (Sichuan).

Draconarius syzygiatus (Zhu & Wang, 1994) 双轮龙隙蛛

Figs 4, 5, 6C, D, 7

Coelotes syzygiatus Zhu & Wang, 1994: 37, f. 1–4 (♀).

Coelotes syzygiatus: Song, Zhu & Chen 1999: 378, f. 225G–H, 227C, 228F (♀).

Draconarius syzygiatus: Wang 2003: 551.

Draconarius syzygiatus: Zhu, Wang & Zhang 2017: 382, f. 247A–D (♀).

Draconarius syzygiatus: L. Y. Wang, Y. C. Wang, Wu & Zhang 2021: 296, f. 9a–g, 67a–g (♂♀).

Type material (not examined). **Holotype** ♀ (JLU), **CHINA, Sichuan Province:** Leshan City, Huangwan County, Mount Emei, near Shengshui Temple, 26.IX.1975, Chuan-Dian Zhu leg.; **Paratype** ♂ (JLU), same data as holotype.

Other materials examined. 2♂♂2♀♀, **CHINA, Sichuan Province:** Ya'an City, Yinjing County, Longcanggou National Forest Park, 29.6247°N, 102.8863°E, elevation: 1447 m, 19.VII.2020, Yi-Yan Li & Mian Wei leg.

Diagnosis. The male of the new species resembles male of *Draconarius pseudoagrestis* Wang, Griswold & Miller, 2010 by the S-shaped ventral margin of conductor with large basal lamellar, the wide and long cymbial furrow, the long embolus and the long and sharp lateral tibial apophysis (Fig. 4B, C; Fig. 217B, C in Zhu *et al.*, 2017). But can be distinguished from the latter by 1) conductor tip pointed upward, while dorsal margin of conductor without basal lamellar (Fig. 4B) [(vs. pointed downward and dorsal margin of conductor with basal lamellar in the latter (Fig. 217B in Zhu *et al.*, 2017)]; 2) median apophysis relatively small, and triangular in retrolateral view (Fig. 4C) [vs. human-ear-shaped and large in the latter (Fig. 217B, C in Zhu *et al.*, 2017)].The female of the new species resembles *Draconarius streptus* (Zhu & Wang, 1994) by the large and keyhole-shaped atrium, the absent of epigynal teeth and with copulatory ducts and spermathecae extending in similar way (Fig. 5; Fig. 238 in Zhu *et al.*, 2017). But can be distinguished from the latter by 1) copulatory ducts coild three times, and the membranous anterior part forming a blind sac (Fig. 5B) [vs. coiled only once, and without blind sac in the latter (fig. 238B in Zhu *et al.*, 2017)]; 2) the end of copulatory ducts ")(" shaped (Fig. 5B) [vs. "()" shaped in the latter (Fig. 238B in Zhu *et al.*, 2017)].

Description (partial). Male (Fig. 6C). See in figure.

Palp (Fig. 4). Patellar apophysis short and digitate. Length of retrolateral tibial apophysis subequal to 2/3 the length of tibia. Lateral tibial apophysis sharp. Cymbial furrow long and wide, more than 2/3 the length of cymbium. Conductor long, distal tip pointed upward. Ventral margin of conductor S-shaped, with large basal lamellar; dorsal margin of conductor without basal lamellar. Dorsal apophysis of conductor thick and short. Embolus long and coiled. Median apophysis small and sclerotized, triangular in retrolateral view.

Female (Fig. 6D). See in figure.

Epigyne (Fig. 5). Epigynal plate weakly sclerotized. Atrium centrally situated, trapezoidal shape. Epigynal teeth absent. Hoods laterally situated. Copulatory ducts coiled, consist with membranous anterior part and weakly sclerotized posterior part; anterior part forming a blind sac, sperm goes clockwise before the tip of blind sac, and then goes anticlockwise. Spermathecae dumbbell-shaped and horizontal, with spermathecal head long and slim, extending to the tip of blind sac. Fertilization ducts short, posteriorly situated.

Distribution: China (Sichuan).

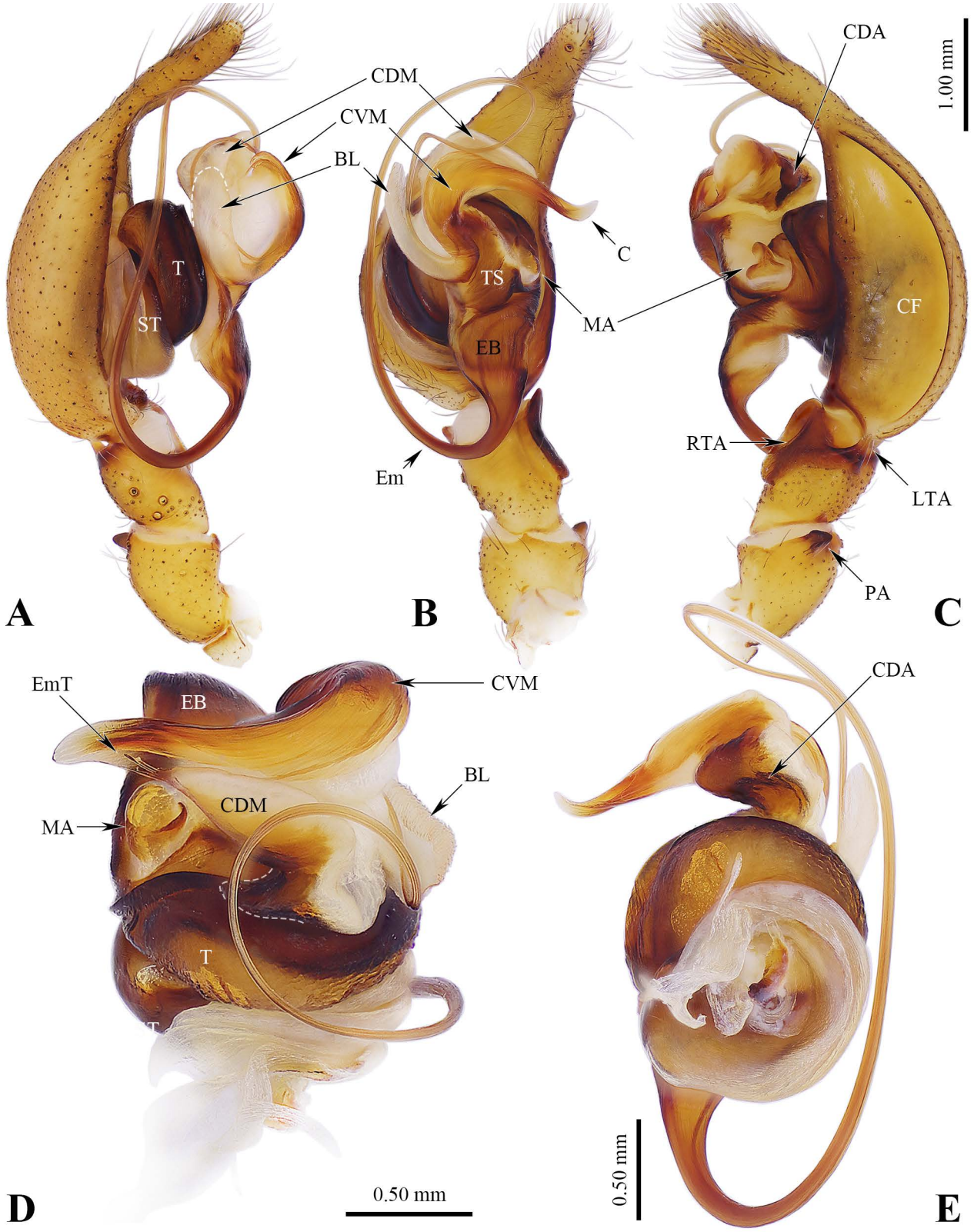

FIGURE 4. *Draconarius syzygiatus* (Zhu & Wang, 1994), male: **A** left palp, prolateral view **B** ditto, ventral view **C** ditto, retrolateral view **D** right bulb horizontally flipped, apical view **E** ditto, dorsal view. Abbreviations: BL = basal lamellar; C = conductor; CDA = dorsal apophysis of conductor; CDM = dorsal margin of conductor; CF = cymbial furrow; CVM = ventral margin of conductor; EB = embolic base; Em = embolus; EmT = embolic tip; LTA = lateral tibial apophysis; MA = median apophysis; RTA = retrolateral tibial apophysis; PA = patellar apophysis; ST = subtegulum; T = tegulum; TS = tegular sclerite.

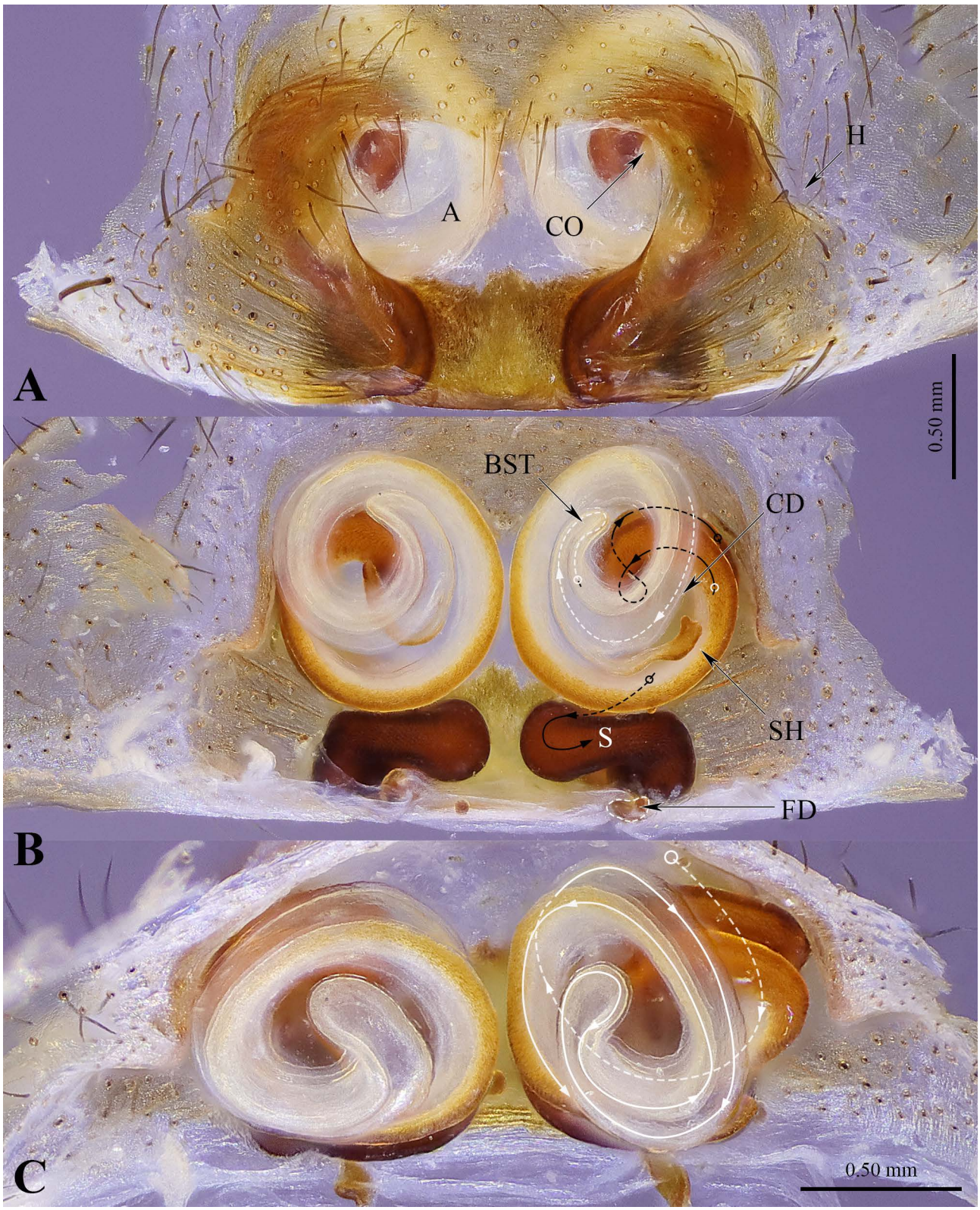

FIGURE 5. *Draconarius syzygiatus* (Zhu & Wang, 1994), female: **A** epigyne, ventral view **B** vulva (white dashed line and arrows indicate the route of sperm), dorsal view **C** ditto, apical view (white lines indicate the track of anterior part of copulatory duct, and black lines indicate the posterior part). Abbreviations: A = atrium; BST = tip of blind sac; CD = copulatory duct; CO = copulatory opening; FD = fertilization duct; H= hood; S = spermatheca; SH = spermathecal head.

FIGURE 6. *Draconarius* spp., habitus: **A** male holotype of *D. feng* **sp. nov.**, dorsal view **B** female paratype of *D. feng* **sp. nov.**, dorsal view **C** male of *D. syzygiatus* (Zhu & Wang, 1994), dorsal view **D** female of *D. syzygiatus*, dorsal view.

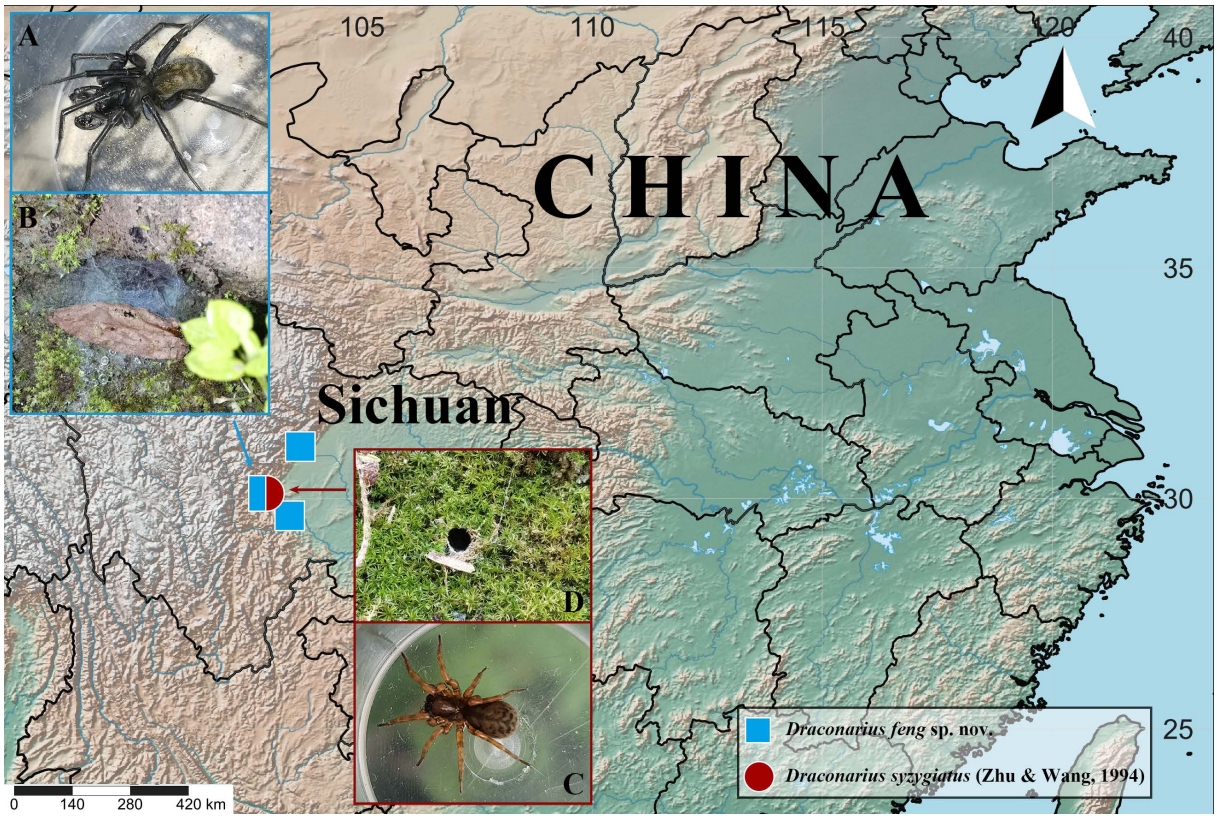

FIGURE 7. Collected localities of *Draconarius* spp.: **A** *D. feng* **sp. nov.**, living male **B** ditto, nest **C** *D. syzygiatus* (Zhu & Wang, 1994), living female **D** ditto, burrow.

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Additional information

Author contributions: Conceptualization: Y-Y Li & M Wei. Project administration: M Wei. Resources: M Wei. Supervision: M Wei. Visualization: M Wei. Writing–original draft: Y-Y Li. Writing–review and editing: M Wei.

Conflict of interest: The authors have declared that no competing interests exist.

Data availability: All of the data that support the findings of this study are available in the main text.

Ethical statement: No ethical statement was reported.

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